14 STAGE BINARY COUNTER/OSCILLATOR

■ DESCRIPTION

The 74HC4060 is an high speed CMOS 14-STAGE BINARY COUNTER/OSCILLATOR fabricated with silicon gate C^2MOS technology. The oscillator configuration allows design of either RC or crystal oscillator circuits. A high level on the CLEAR accomplishes the reset function, i.e. all cououtputnter are made low and the oscillator is disabled. A negative transition on the clock input increments the counter. Ten kinds of divided output are provided; 4 to 10 and 12 to 14 stage inclusive. The maximum division available at Q12 is 1/16384 f oscillator.

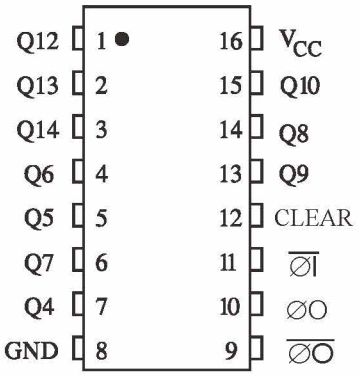
The Clock Input ($\overline{\varnothing I}$) and the CLEAR input are equipped with protection circuits against static discharge and transient excess voltage.

- LOW POWER DISSIPATION:
- I_{CC} =4 μA(MAX.) at T_A=25°C
- SYMMETRICAL OUTPUT IMPEDANCE:
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN)
- BALANCED PROPAGATION DELAYS:
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
  V_{CC} (OPR) = 2 V to 6 V
- TA = -40° to 125° C for all packages

■ PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
01, 02, 03	Q12 to Q14	Counter Outputs
07, 05, 04, 06, 14, 13, 15	Q4 to Q10	Counter Outputs
09	$\overline{\varnothing O}$	External Capacitor Connection
10	∅O	External Resistor Connection
11	$\overline{\varnothing I}$	Clock Input / Oscillator
12	CLEAR	Master Reset
08	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

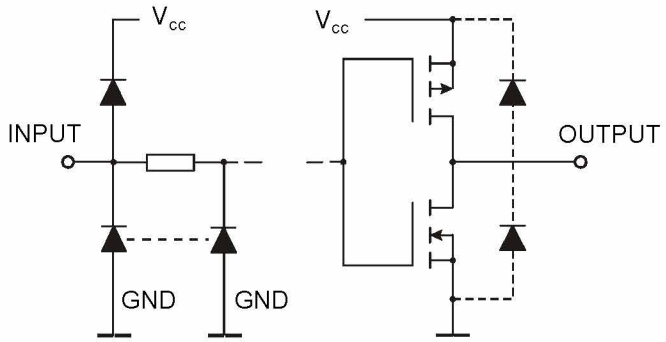
■ PIN ASSIGNMENT



■ ORDERING INFORMATION

Part Number	Package	Packing	Temperature(TA)	Package Qty
74HC4060D	SOIC-16	Reel	-40°C ~ 125°C	2500
74HC4060P	TSSOP-16	Reel	-40°C ~ 125°C	2500

INPUT AND OUTPUT EQUIVALENT CIRCUIT

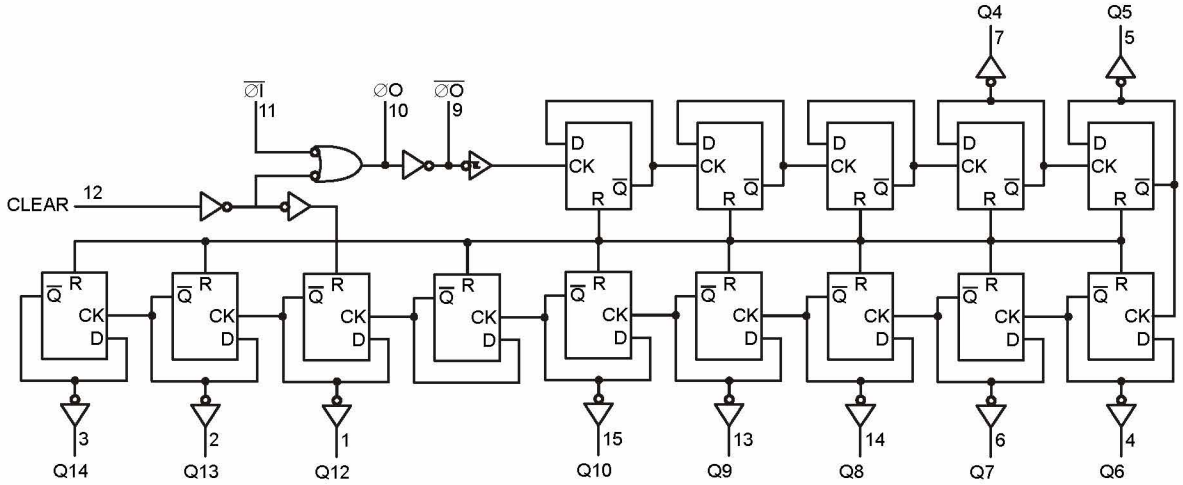


TRUTH TABLE

$\overline{\varnothing I}$	CLEAR	FUNCTION
X	H	COUNTER IS RESET TO ZERO STATE ∅O OUTPUT GOES TO HIGH LEVEL $\overline{\varnothing O}$ OUTPUT GOES TO LOW LEVEL
⌐	L	COUNT UP ONE STEP
⌐	L	NO CHANGE

X : Don't Care

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7	V
V_I	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
Tstg	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage		2 to 6	V
V_I	Input Voltage		0 to V_{CC}	V
V_O	Output Voltage		0 to V_{CC}	V
T_{OP}	Operating Temperature		-55 to +125	°C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2.0 V	0 to 1000	ns
		V_{CC} = 4.5 V	0 to 500	ns
		V_{CC} = 6.0 V	0 to 400	ns

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition		Value				Unit
		V_{CC} (V)		T_A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
V_{IH}	High Level Input Voltage	2.0		1.5		1.5		V
		4.5		3.15		3.15		
		6.0		4.2		4.2		
V_{IL}	Low Level Input Voltage	2.0			0.5		0.5	V
		4.5			1.35		1.35	
		6.0			1.8		1.8	
V_{OH}	High Level Output Voltage (Q Output)	2.0	I_O = -20 μA	1.9		1.9		V
		4.5	I_O = -20 μA	4.4		4.4		
		6.0	I_O = -20 μA	5.9		5.9		
		4.5	I_O= -4.0 μA	4.18		4.10		
		6.0	I_O = -5.2 μA	5.68		5.60		
V_{OL}	Low Level Output Voltage (Q Output)	2.0	I_O = 20 μA		0.1		0.1	V
		4.5	I_O = 20 μA		0.1		0.1	
		6.0	I_O = 20 μA		0.1		0.1	
		4.5	I_O= 4.0 μA		0.26		0.40	
		6.0	I_O= 5.2 μA		0.26		0.40	
V_{OH}	High Level Output Voltage (∅O, $\overline{\varnothing O}$ Output)	2.0	I_O = -20 μA	1.8		1.8		V
		4.5	I_O = -20 μA	4.4		4.0		
		6.0	I_O = -20 μA	5.5		5.5		
V_{OL}	Low Level Output Voltage (∅O, $\overline{\varnothing O}$ Output)	2.0	I_O = 20 μA		0.2		0.2	V
		4.5	I_O = 20 μA		0.5		0.5	
		6.0	I_O = 20 μA		0.5		0.5	
I_I	Input Leakage Current	6.0	V_I= V_{CC} or GND		±0.1		±1	μA
I_{CC}	Quiescent Supply Current	6.0	V_I= V_{CC} or GND		4		80	μA

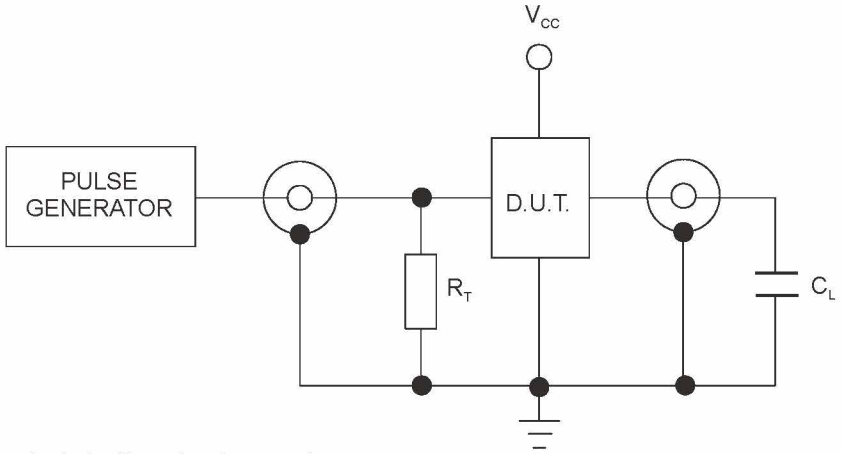
AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input $t_r = t_f$ = 6 ns)

Symbol	Parameter	Test Condition		Value				Unit
		V_{CC} (V)		T_A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
t_{TLH}, t_{THL}	Output Transition Time	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t_{PLH}, t_{PHL}	Propagation Delay Time ($\overline{\varnothing}$I-Q4)	2.0			300		450	ns
		4.5			60		90	
		6.0			51		76	
t_{PD}	Propagation Delay Time Difference (Qn – Qn+1)	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t_{PHL}	Propagation Delay Time (CLEAR – Qn)	2.0			195		295	ns
		4.5			39		59	
		6.0			33		50	
f_{MAX}	Maximum Clock Frequency	2.0		6		4		MHz
		4.5		30		20		
		6.0		35		24		
$t_{W(H)}$, $t_{W(L)}$	Minimum Pulse Width ($\overline{\varnothing}$I)	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
$t_{W(H)}$	Minimum Pulse Width (CLEAR)	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t_{REM}	Minimum Removal Time	2.0			100		150	ns
		4.5			20		30	
		6.0			17		26	

CAPACITIVE CHARACTERISTICS

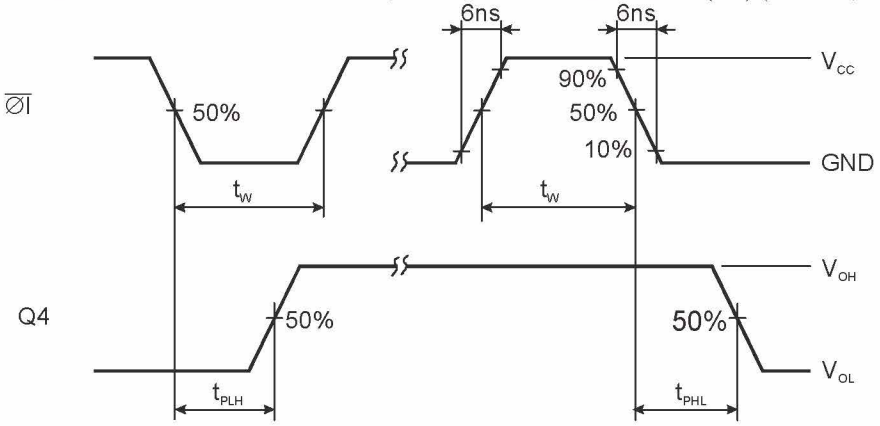
Symbol	Parameter	Test Condition		Value				Unit
		V_{CC} (V)		T_A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
C_{IN}	Input Capacitance	5.0			10		10	pF

TEST CIRCUIT

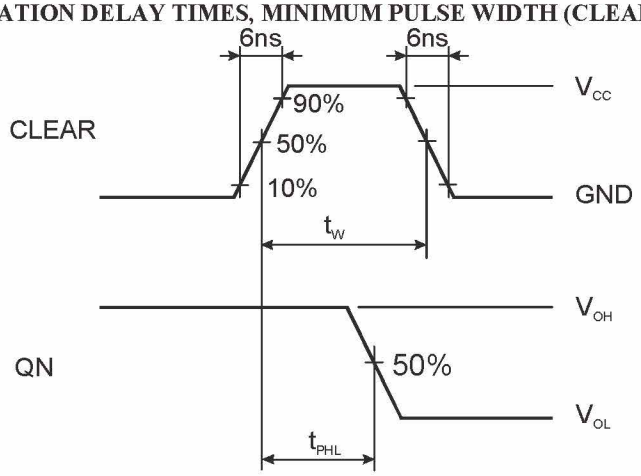


C_L = 50 pF or equivalent (includes jig and probe capacitance)
R_L = Z_{OUT} of pulse generator (typically 50 Ω)

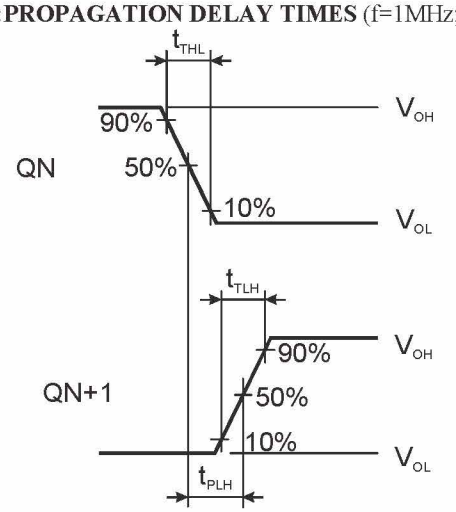
WAVEFORM 1: PROPAGATION DELAY TIMES, MINIMUM PULSE WIDTH ($\overline{\varnothing I}$) (f=1MHz; 50% duty cycle)



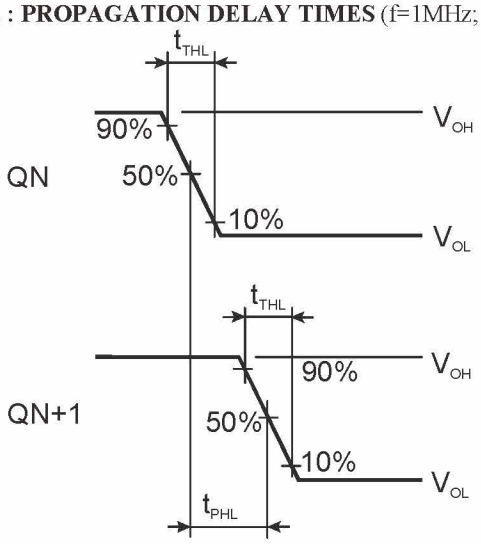
WAVEFORM 2 : PROPAGATION DELAY TIMES, MINIMUM PULSE WIDTH (CLEAR) (f=1MHz; 50% duty cycle)



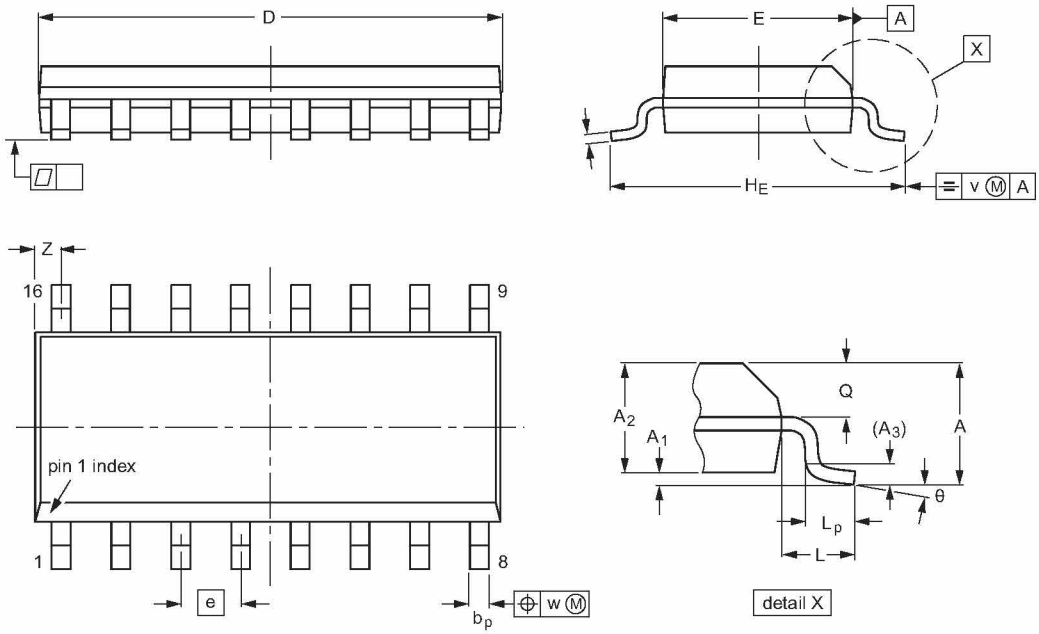
WAVEFORM 3 :PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 4 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



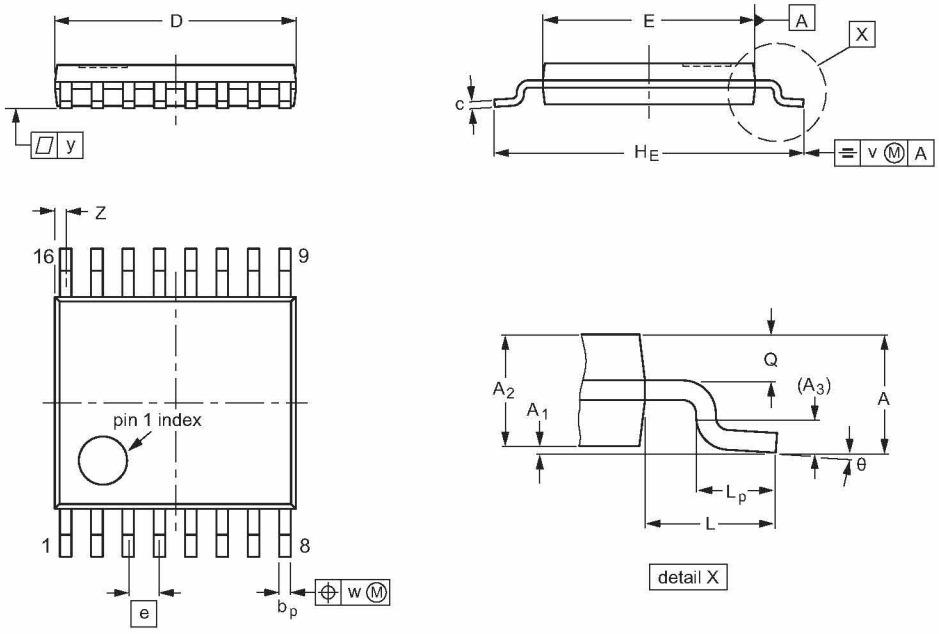
SOIC16: plastic small outline package; 16 leads; body width 3.9 mm



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°